TO: 12/Science and Flight Projects Contracting Branch, Office of Procurement

FROM: 489/R. Keith Johnson, Aerospace Engineer, Atmospheric Flight and Entry Systems Branch, Engineering Directorate

SUBJECT: Justification for Exception to the Fair Opportunity Process (JEFOP) for Proposed Task Order for Hypersonic Inflatable Aerodynamic Decelerator (HIAD) Aeroshell Design, Fabrication and Testing with Airborne Systems Contract NNL12AA02B, Estimated Value $3.5M

In accordance with FAR 16.505, the following information is provided to support this justification:

I. Recommendation

NASA Langley Research Center (LaRC) intends to award a task order directly to Airborne Systems North America under the existing Inflatable Aerodynamic Decelerators (IAD) contract no. NNL12AA02B. The purpose of this task order is to perform detailed design, fabrication and testing of an inflatable aeroshell system to be integrated with existing NASA vehicle hardware for a space flight demonstration mission.

Airborne Systems is the sole source capable of performing the required effort because it is the only contractor that has developed an inflatable aeroshell design having a demonstrated performance capability required by NASA and a design compatible with existing space flight hardware. Airborne Systems is also the only contractor that can deliver a designed and tested aeroshell that will meet NASA's flight demonstration schedule.

The Government estimate for this proposed task order is $3.5M. LaRC will use the Indefinite Delivery/Indefinite Quantity (IDIQ) contract with Airborne Systems for this task. The contract with Airborne Systems is one of three multiple award IAD contracts. The IAD contracts were awarded in December 2011.

II. Background

In April 2011, NASA Request for Proposal NNL11ZB1005R was released to solicit for development of IAD technology for space vehicle aerocapture and Entry, Descent, and Landing (EDL) for atmospheric entry applications in hypersonic, supersonic, transonic and subsonic regimes. Under the IAD contracts, task orders may be issued for a range of aerocapture and EDL applications including, but not limited to, test coupons, ground articles, engineering development units, and space flight units. As a result of this full and open competition, four proposals were received; and three

contract awards were issued by NASA LaRC to Airborne Systems (Contract No. NNL12AA02B), Lockheed Martin (Contract No. NNL12AA04B), and ILC Dover (Contract No. NNL12AA03B).

The Terrestrial HIAD Orbital Reentry (THOR) project at NASA LaRC is planning to conduct a flight demonstration of a sub-scale inflatable aeroshell. The THOR project is funded under the Game Changing Development (GCD) program of the NASA Space Technology Mission Directorate (STMD). The primary objective is to validate the performance of a stacked-toroid inflatable aerodynamic decelerator under heat load requirements representative of a Mars atmospheric entry vehicle. The NASA test vehicle will be a secondary payload on the Antares launch vehicle as part of an International Space Station (ISS) Cargo resupply mission conducted by Orbital Sciences Corporation (OSC). A significant constraint of the inflatable aeroshell is the requirement to integrate with the existing NASA vehicle centerbody. After reaching Earth orbit, the inflatable aeroshell will be released from Antares second stage motor for Earth re-entry, descent and water landing. This test will advance the technology to Technology Readiness Level (TRL) 6 and provide an increased landed mass capability for future planetary missions.

III. Nature and/or Description of Required Supplies/Services

The proposed task order is for design, fabrication and testing of a nominal 3.7 meter diameter inflatable aeroshell as the Antares secondary payload flight demonstration. The major deliverables for the task include an Engineering Development Unit (EDU) and a Flight Unit of the inflatable aeroshell. The inflatable aeroshell is comprised of an inflatable structure and a flexible thermal protection system that interfaces with existing NASA entry vehicle hardware and attachment features. The requirements include configuration design, material characterization tests, inflatable structure fabrication, flexible thermal protection system manufacture, aeroshell packing demonstration, aeroshell load tests and delivery of documentation. In order to meet the demonstration project's goals and mission requirements, the aeroshell flight unit must be delivered by April 30, 2015.

IV. Identification of the Exception to Fair Opportunity and Supporting Rationale

FAR 16.505(b)(1)(i) requires the Contracting Officer provide each awardee under a multiple award contract a fair opportunity to be considered for each order exceeding $3,000 unless a statutory exception applies. The exception that precludes fair opportunity for this acquisition is FAR 16.505(b)(2)(i)(B), which states that "Only one awardee is capable of providing the services or supplies at the level of quality required because the service or supplies ordered are unique or highly specialized." The aeroshell design by Airborne is based on a proprietary inflatable stacked-toroid construction unitized by a system of load straps that attach the aeroshell to an entry

vehicle. The flight capability of the stacked-toroid inflatable aeroshell approach was successfully demonstrated by NASA LaRC's Inflatable Re-entry Vehicle Experiment (IRVE)-3 sounding rocket flight demonstration performed in July 2012. The IRVE experiment successfully demonstrated exo-atmospheric deployment, structural performance, aerodynamic stability and structural integrity under aerodynamic loads. The Antares flight demonstration will have similar requirements. Also, the stacked torus design can be easily modified to accommodate the slightly larger 3.7 meter diameter size estimated for the Antares entry requirements. The primary performance difference between the IRVE-3 and Antares entry is a higher heat load requirement for Antares which is needed to demonstrate the full thermal capabilities of the flexible thermal protection system. The Airborne IRVE-3 stacked torus aeroshell design, demonstrated heat load performance, and resulting TRL assessment of 5, enables Airborne to meet the challenging heat load requirement for the Antares flight.

Tasks were issued under the IAD multiple award contracts to Lockheed Martin and ILC Dover in August 2012 to advance the development of alternative inflatable aeroshell designs. The purpose of the conceptual design tasks was for the Contractors to develop their aeroshell design, materials, construction methods, and vehicle interface attachment methods to meet a representative performance for an Earth entry mission application. The conceptual design provided by Lockheed Martin and ILC Dover appear to be feasible, however these conceptual designs are developmentally immature at TRL 2 to 3 and are not capable of meeting the stringent heat load performance requirements in time to support the THOR flight test.

Another significant constraint is that the aeroshell design must be compatible with the existing vehicle centerbody attachment points, geometry and inflation system. The existing centerbody and inflation system are the same as that used for the IRVE-3 flight demonstration. Airborne Systems' stacked torus design with straps to attach to the centerbody is already capable of integration with the existing centerbody as demonstrated with the IRVE-3 flight demonstration. The existing centerbody and inflation system has been analyzed and certified for flight. Currently, Lockheed Martin and ILC Dover's conceptual designs have centerbody attachment approaches that are unique to each proprietary inflatable aeroshell innovation and are therefore not compatible with the existing centerbody design and attachment hardware. Additionally, inflation volumes and pressures change differences with the Lockheed Martin or ILC Dover design may require inflation system changes. Combining all of the costs for design, analysis, fabrication and testing to modify centerbody interfaces the total could easily exceed $500,000 just to bring the other designs to the level of the existing Airborne design.

The THOR project must commit to a specific schedule for approval as the aeroshell demonstration flight test will be a secondary payload on an OSC Antares vehicle to be launched out of NASA Wallops Flight Facility (WFF). The secondary payload

opportunities for the THOR test are flights designated as ISS Commercial Resupply Services (CRS) Mission Orbital-5 (Orb-5) and Orbital-6 (Orb-6) which are currently scheduled for July 2015 and January 2016 respectively. To meet the launch vehicle integration for Orb-5 test and launch operations, the NASA THOR test vehicle with integrated aeroshell must be delivered to the Horizontal Integration Facility (HIF) at WFF about 2 months prior to launch. To meet the launch schedule, the aeroshell flight unit needs to be delivered to NASA in April 2015 to begin flight vehicle integration. Airborne's unique stacked torus aeroshell is the sole design with a technical maturity capable of meeting the complex technical requirements, the only design compatible with existing flight hardware, and Airborne is the only contractor capable of meeting the demanding delivery schedule of April 2015.

V. Determination by the Contracting Officer That the Anticipated Cost to the Government Will Be Fair and Reasonable

The cost plus fixed fee amount for this acquisition will be determined fair and reasonable by the Contracting Officer prior to award of the task order. The contractor will be required to submit certified cost and pricing data and the Contracting Officer will use the policies and methods in FAR 15.4 to assess the proposed cost.

VI. Other Facts Supporting the Justification

None

VII. Actions the Agency May Take to Remove or Overcome Any Barriers to Increasing Fair Opportunity before Any Subsequent Acquisition for the Supplies or Services

NASA may have future requirements that can only be met by Airborne Systems. However, the Contracting Officer will continue to scrutinize all new task requirements to ensure fair opportunity is appropriately given; and NASA will take proactive steps to eliminate barriers to competition for future requirements. As mentioned in section IV above, NASA has previously awarded conceptual design tasks to Lockheed Martin and ILC Dover in an attempt to develop competing designs. NASA will continue to look for further development opportunities as funding allows.